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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/694,172	10/28/2003	Kazuyoshi Ueno	Q78176	2754
23373	7590	11/20/2007		
SUGHRUE MION, PLLC 2100 PENNSYLVANIA AVENUE, N.W. SUITE 800 WASHINGTON, DC 20037			EXAMINER TSOY, ELENA	
			ART UNIT 1792	PAPER NUMBER
			MAIL DATE 11/20/2007	DELIVERY MODE PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/694,172	Applicant(s) UENO ET AL.	
	Examiner Elena Tsoy	Art Unit 1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 31 October 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-5, 7 and 9-19 is/are pending in the application.
- 4a) Of the above claim(s) 1-5 and 12-17 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 7, 9-11, 18 and 19 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ | 6) <input type="checkbox"/> Other: |

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on October 31, 2007 has been entered.

Response to Amendment

Amendment filed on October 1, 2007 has been entered. New claims 18-19 have been added. Claims 1-5, 7, 9-19 are pending in the application. Claims 1-5, 12-17 are withdrawn from consideration as directed to a non-elected invention.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 7, 9, 18, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al (US 6180523) in view of Sambucetti et al (US 6335104).

Lee et al are applied here for the same reasons as set forth in paragraph 9 of the Office Action mailed on 5/31/2007. Lee et al teach that a second barrier layer 46 may be formed on the wiring layer 38 by electroless *plating*, wherein the second barrier layer 46 is made of a nickel-

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boron, Pd or Co or Cu, Au, most preferably of Ni-B to reduce the resistivity (See Fig. 8; column 10, lines 36-37) for *copper migration* (See column 4, lines 19-20). Lee et al further teach that the first barrier layer 34, diffusion prevention layer for the **metal layer of e.g. Cu** or Au (See Fig. 9; column 6, lines 1-2) is preferably composed of electroless plated layer of Ni, Pd, Co or alloys thereof, but not *limited* to these (See column 8, lines 49-56). Lee et al do not expressly teach that the first barrier layer 34 (claimed diffusion prevention layer) may also be made of nickel-boron. However, since Lee et al teach that the first barrier layer 34 is not *limited* to Ni, Pd, Co or alloys thereof, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have made the first barrier layer 34 of nickel-boron instead of Pd or Co with the expectation of providing the desired reduced resistivity depending on particular use of a final product.

Lee et al fail to teach that the first barrier layer 34 comprises a plating film selected from the group consisting of Ni-W-P and Ni-Rh-P (Claim 7).

Sambucetti et al teach that a diffusion barrier layer 16 of a metal alloy material such as a phosphorus or boron-containing alloy of Ni-P, Co-W-P, Co-Sn-P, Ni-W-P, Co-B, Ni-B, Co-Sn-B, Co-W-B and Ni-W-B is suitable for prevention of copper diffusion (See FIG. 1; column 5, line 61 to column 6, line 18).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used Ni--W--P as a diffusion prevention film in Lee et al with the expectation of providing the desired prevention of the first Cu layer from diffusing since Sambucetti et al teach that an electroless Ni-B film or Ni--W--P film is suitable for preventing Cu from diffusion, and Lee et al do not limit their teaching to particular Ni alloys.

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As to claimed thickness, Sambucetti et al teach that a suitable thickness for the first diffusion barrier layer 16 may be within a range of 1,000-10,000 ÅNG. (100-1,000 nm) (See column 6, lines 2-7), e.g. **100 nm** (See Example A) (See column 6, lines 29-30).

Moreover, the Examiner takes official notice that it is a common knowledge in the art that effect of protection layer depends on the thickenss of the layer. It is held that it is not inventive to discover the optimum or workable ranges of result-effective variables by routine experimentation. In re Antonie, 559 F.2d 618, 195 USPQ 6 (CCPA 1977). See also In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). It would have been obvious to one of ordinary skill in the art at the time the invention was made to have determined the optimum values of the relevant thickness parameters (including those of claimed invention) in the cited prior art through routine experimentation in the absence of showing of criticality.

As to claim 18, it is held that concentration limitations are obvious absent a showing of criticality. Akzo v. E.I. du Pont de Nemours 1 USPQ 2d 1704 (Fed. Cir. 1987).

3. Claims 9-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al in view of Sambucetti et al, further in view of Neary (US 4424805) and Vullaume et al (Applied Physics Letters, vol. 69, pages 1646-1648, 1996) described by Wada et al (US 20050056828) for the reasons discussed above and for the reasons of record set forth in paragraph 10 of the Office Action mailed on 5/31/2007.

4. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al in view of Sambucetti et al, further in view of Sliwa (US 4990462).

Lee et al in view of Sambucetti et al are applied here for the same reasons as above. Lee et al in view of Sambucetti et al fail to teach that tungsten or rhenium content is 40-80% by weight, the phosphorous content is 0.1-1.0 % by weight and the residual is nickel.

Sliwa teaches that in a solderable metallurgy, a plated **gold or copper** is provided with an underlying diffusion barrier such as **nickel or tungsten** (See column 27, lines 92-65). In other words, Sliwa teaches that tungsten is functionally equivalent to nickel as a gold or copper diffusion barrier.

It is well settled that it is prima facie obvious to combine two compositions each of which is taught by the prior art to be useful for the same purpose, in order to form a third composition which is to be used for the very same purpose. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used a combination of nickel or tungsten in any ratio with the expectation of providing the desired diffusion gold or copper barrier since Sliwa teaches that tungsten is functionally equivalent to nickel as a gold or copper diffusion barrier.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have determined the optimum values of the relevant concentration parameters (including those of claimed invention) in the cited prior art through routine experimentation in the absence of showing of criticality.

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Wu et al (US 6184061) teach that an electroless Ni--P film 22a which is a part of an electroless *barrier* metal film 22 is a diffusion prevention film formed for preventing Cu, which

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is a material of the pad 20, from diffusing (See column 4, lines 60-67). Also where the electroless Ni--P film 22a used as the electroless diffusion prevention film, an electroless **Ni-B** film, an electroless Ni--N film or an electroless film of an Ni alloy such as Ni--Sn --P, Ni--Sn--B, **Ni--W--P**, Ni--W--B, Ni--Co--P, Ni--Cu--P, Ni--Cu--B, etc., may be used as the electroless diffusion prevention film (See column 9, lines 39-51).

Response to Arguments

6. Applicant's arguments with respect to claims 7, 9-11, and 18-19 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Elena Tsoy whose telephone number is 571-272-1429. The examiner can normally be reached on Monday-Thursday, 9:00AM - 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks can be reached on 571-272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR

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system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Elena Tsoy, Ph.D.
Primary Examiner
Art Unit 1792

ELENA TSOY
PRIMARY EXAMINER

ETsoy

November 14, 2007